

## A FEED METERING DEVICE

The present invention relates to a feed metering device according to the preamble of claim 1. Such a feed unit may be constituted by a manger or feeding trough, or by a unit provided with a nipple, e.g. for calves.

Such a feed metering device is known from European patent application EP-A-0610171. By means of a control unit the closing means of this known feed metering device is actively kept in the position in which it closes the manger or feeding trough.

It is one of the objectives of the present invention to provide an alternative feed metering device for distributing fodder and/or drink in metered portions to an animal, which device, on the one hand, deters in a constructively simple, efficient and cheap manner animals that are not eligible for being fed from putting their heads into the feed unit, and, on the other hand, offers additional advantages.

For that purpose, in accordance with the invention, a feed metering device of the above described type is characterized by the measures according to the characterizing part of claim 1.

The feed metering device preferably includes an animal identification device, the roll being controlled with the aid of data from the animal identification device.

In an embodiment of a feed metering device according to the invention, there is obtained a compact construction when the roll is disposed in the vicinity below the entrance opening. Preferably there is disposed a housing in the vicinity below the entrance opening, in which housing the roll is mounted.

The closing means may be formed by a separate component, but is preferably constituted by the feed unit itself, which is designed as a movable one. As a result thereof the number of components is limited and the feed metering device can be manufactured cheaply.

In order to prevent fodder and/or drink from falling from the feed unit in certain positions of the feed unit, the

latter comprises a wall portion for catching remaining fodder and/or drink. Said wall portion can also act as a feed guide means for fodder and/or drink that is supplied by the feed supplying device to the feed unit.

5 A stable construction is obtained when the feed unit bears on the housing via the roll.

The motor is preferably included in the housing, so that a compact construction is obtained. The housing also serves for protecting the motor against contamination, damage and the like.  
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A quick and accurate identification of animals is obtained when the animal identification device is included in the housing, the animal identification device then also being guarded against contamination, damage and the like.

15 The feed metering device preferably comprises further deterring means for deterring an animal, which include a loudspeaker for producing an animal-frightening sound. Certain animals have appeared to be highly sensitive to certain sounds, so that a loudspeaker is very appropriate for deterring such animals. Moreover, such a loudspeaker may be used for producing  
20 calming or stimulating sounds when an animal uses the feed metering device correctly.

Alternatively or additionally, the further deterring means may include means for generating an animal-frightening  
25 light. In particular when a plurality of feed metering devices are disposed side by side, the use of frightening light is desired, as this light can be directed in such a manner that its effect is limited to one particular feed metering device.

The further deterring means may include a voltage  
30 emitting device for emitting an animal-frightening electric voltage. Sound and light have proved to be effective for deterring unwanted animals, but have the disadvantage of being observable sometimes at a greater distance from the relevant feed metering device. Animals that undesirably visit a feed  
35 metering device often make contact with the feed metering device, usually with their noses. By linking with a voltage emitting device precisely those components of the feed metering

device that are regularly touched by the animals, it is possible to deter a particular animal very locally. Alternatively, a forced air flow may be used for deterring the animal.

A preferred embodiment of a feed metering device according to the invention is characterized in that the feed metering device is provided with means for weighing the fodder and/or drink present in the feed unit, which means move the feed unit in a pivoting respectively a rotating manner. Thus it is possible to determine how much fodder and/or drink is consumed by a particular animal. On the basis thereof the amount of fodder and/or drink consumed by an animal can be determined in the course of time and accordingly the health condition of an animal can be deduced; for, when an animal unexpectedly takes a smaller amount of fodder and/or drink, this may be a signal that the animal is ill. Moreover, it is undesirable that, when an animal leaves a certain amount of fodder and/or drink, the amount of fodder and/or drink for the next animal is supplied to the feed unit without these remnants being taken into account. The means for weighing the fodder and/or drink present in the feed unit are preferably linked with the feed supplying device for supplying an amount of fodder and/or drink to the feed unit with the aid of data both from the animal identification device and the weighing means.

The means for weighing the fodder and/or drink present in the feed unit may comprise a feed unit which is pivotable about a hinge pin, the degree of pivotability being determined by the weight of the fodder and/or drink present in the feed unit, and a device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the fodder and/or drink present in the feed unit. The degree of pivotability of the feed unit depends on the amount of fodder and/or drink in the feed unit. The more fodder and/or drink, the larger the degree of pivotability. The exact correlation between the degree of pivotability and the amount of fodder and/or drink can previously be determined by means of simple calibration tests.

A compact construction of the feed metering device is obtained when the device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the amount of fodder and/or drink present in the feed unit, is integrated in the animal identification device.

When the device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the amount of fodder and/or drink present in the feed unit comprises a measuring roll which is in contact with the feed unit, it is possible to determine from the degree of rotation of the roll the degree of pivotability and thus the amount of fodder and/or drink in the feed unit.

Alternatively or additionally, the device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the amount of fodder and/or drink present in the feed unit, comprises a load sensor, the feed unit bearing on the load sensor. The load sensor is preferably included in the animal identification device.

In order to be able to measure even a small difference in weight, in a preferred embodiment of a feed metering device according to the invention, the hinge pin and the load sensor respectively the measuring roll are located at a small distance from each other.

In order to prevent for example the load sensor from being damaged in the undesired event of a defect, there is provided a safety supporting bracket for the feed unit.

A preferred embodiment of a feed metering device according to the invention is characterized in that the means for weighing the fodder and/or drink present in the feed unit comprise a movable feed unit, a motor for moving the feed unit, a device for measuring the magnitude of the torque during movement, and for deducing, from the magnitude of the torque measured, the weight of the fodder and/or drink present in the feed unit. The magnitude of the torque generated by the movement of the feed unit depends on the amount of fodder and/or drink in

th feed unit. Also in this situation, the exact correlation between torque and amount of fodder and/or drink can previously be determined by means of simple calibration tests.

5 A compact feed metering device is obtained when the motor for moving the feed unit and the device for measuring the magnitude of the torque during movement and for deducing, from the magnitude of the torque measured, the weight of the fodder and/or drink present in the feed unit, are integrated in the animal identification device.

10 A mechanically simple but accurate construction is obtained when the motor for moving the feed unit drives a torque roll, said torque roll being in contact with the feed unit.

15 According to the invention, the means for deterring an unwanted animal and the means for measuring the amount of fodder and/or drink in the feed unit can be combined in one means, in that the roll for driving the feed unit as a closing means and the torque roll used on measuring the torque are constituted by one roll.

20 In order to be able accurately to perform animal identification and to obtain at the same time a compact construction, a feed metering unit according to the present invention is characterized in that the animal identification device is disposed in the vicinity below the entrance opening.

25 The invention will be explained hereinafter in further detail with reference, by way of example, to the drawing in which:

Figure 1 is a first embodiment of a feed metering device according to the invention;

30 Figure 2 is a second embodiment of a feed metering device according to the invention;

Figure 3 is a third embodiment of a feed metering device according to the invention;

35 Figure 4 is a fourth embodiment of a feed metering device according to the invention, and

Figure 5 is a fifth embodiment of a feed metering device according to the invention.

Figure 1 shows schematically a first embodiment of a feed metering device 1 according to the invention. The feed metering device 1 distributes fodder and/or drink (hereinafter to be denoted by feed, by which is meant fodder and/or drink), in metered portions to an animal, and is provided with a feed unit 10, also called manger or feeding trough, for containing feed. An entrance opening 11 makes the feed unit 10 accessible to an animal, for example but not exclusively a cow. An animal identification device 12, known per se, recognizes a particular animal that approaches the feed unit 10 and wishes to use it. The animal identification device 12 is preferably disposed in the feed metering device 1, but may alternatively also be disposed at a distance therefrom. A feed supplying device 13 supplies an amount of feed to the feed unit 10, possibly with the aid of data from the animal identification device 12, the feed of a non-shown feed stock entering the feed unit 10 via e.g. a (non-shown) valve and a chute 14.

Thus it is possible for the feed metering device 1 to recognize a particular cow, e.g. by means of a transponder fitted to or on the cow. The feed supplying device 13 is controlled in a manner known per se by software that ensures that the right amount of feed is distributed to the relevant cow.

The feed metering device 1 according to the embodiment of Figure 1 is provided with a (non-shown) closing means. Such a closing means will be illustrated in Figure 2. The feed metering device 1 may additionally be provided, on a closing means, with deterring means 15, 16 for deterring an animal that visits the feed unit at an undesired point of time and actually wishes to use it. The deterring means are preferably controlled with the aid of data from the animal identification device. This provides an extra manner to deter animals that are not eligible for being fed, in a simple, efficient and cheap way, from putting their heads into the feed unit.

In the embodiment shown in Figure 1, the further deterring means include a loudspeaker 16 for producing an

animal-frightening sound. Alternatively or additionally, the further deterring means may include a lighting device 15 for emitting an animal-frightening light. In particular when a plurality of feed metering devices are disposed side by side, the use of frightening light may be desirable, as this light can be directed in such a manner that its effect is limited to one particular feed metering device.

Figure 2 shows schematically an embodiment of a feed metering device 2 according to the invention. In this embodiment the closing means 25 is constituted by a separate vessel-like element which is capable of rotating about an axis 26 and is movable across the entrance opening 21. When the closing means 25 is moved across the entrance opening 21, the contents of the feed unit 20 can be made inaccessible to a particular animal.

Additionally, there may be provided further deterring means in the form of a voltage emitting device 27 for emitting an animal-frightening electric voltage to the closing means 25. Animals that undesirably approach the feed metering device 2 often make contact with the feed metering device 2. In particular they will touch the closing means 25 with their noses. By linking with the voltage emitting device 27 precisely those components of the feed metering device that are regularly touched by the animals, it is possible to deter a particular animal very locally as an additional measure. This second embodiment of a feed metering device 2 according to the invention also comprises a feed supplying device 23 and a chute 24 for the feed.

Figure 3 shows schematically a third embodiment of a feed metering device 3 according to the invention. In this embodiment the closing means is constituted by the feed unit 30 itself, which is designed as a movable one. In the embodiment shown the feed unit 30 is rotatably disposed about an axis 36. In order to prevent that, in the position in which the feed unit 30 closes the entrance opening 31, feed falls from the feed unit 30, the feed unit 30 comprises a wall portion 35 for catching remaining feed. Said wall portion 35 can also act as a feed

guide means for feed that is supplied to the feed unit 30 via the chute 34 of the feed supplying device 33.

For the purpose of providing, besides a simple but reliable construction, also a compact construction, according to the invention a roll 29 respectively 39 (or 19) is driven by a motor 28 respectively 38, which roll 19, 29, 39 contacts the closing means 25 respectively 30. Preferably the feed unit 30 thus bears on the animal identification device 32 via the roll 39.

An extremely compact construction is obtained when the motor 28, 38 and the roll 29, 39 are included in a housing B, C, which is disposed in the vicinity below the entrance opening. Preferably the housing also contains the relevant animal identification devices 22, 32.

According to the invention, the feed metering device may be provided with means for weighing the feed present in the feed unit, which means move the feed unit in a pivoting respectively a rotating manner. With the aid of said means it is possible to determine how much feed is consumed by a particular animal, and at the same time whether remaining feed is present in the feed unit. The means for weighing the feed present in the feed unit are preferably connected to the feed supplying device for supplying an amount of feed to the feed unit with the aid of data both from the animal identification device and the weighing means, so that the amount of feed left by the previous animal can be taken into account.

In the embodiment of Figure 1 the means for weighing the feed present in the feed unit 10 comprise a feed unit 10 which is pivotable about a hinge pin 17. The degree of pivotability is determined by the weight of the feed present in the feed unit 10. There is provided a device 18 for determining the degree of pivotability of the feed unit 10 and for deducing therefrom the weight of the feed present in the feed unit 10. The device 18 for determining the degree of pivotability of the feed unit 10 comprises a measuring roll 19 which is in contact with the feed unit. From the degree of rotation of the roll 19



the degree of pivotability and thus the amount of feed in the feed unit 10 can be determined.

Due to the fact that the device 18, 19 for determining the degree of pivotability of the feed unit 10 is integrated in the housing A, in which e.g. the animal identification device 12 may be disposed as well, a compact construction of the feed metering device is obtained. Alternatively, the device 18, 19 may be located outside the housing A.

As shown in the embodiment of Figure 2, the device 201 for determining the degree of pivotability of the feed unit 20 and for deducing therefrom the weight of the feed present in the feed unit 20 may alternatively or additionally comprise a load sensor 202. In the embodiment shown the feed unit 20 bears on the load sensor 202 via a supporting arm 203, while the feed unit 20 pivots about a hinge pin 204. The load sensor 202 is preferably included in the housing B.

In the embodiments shown in figures 1 and 2, even small differences in weight can be measured due to the fact that the hinge pin 17, 204 and the measuring roll 19 respectively the load sensor 202 are located at a small distance from each other.

In order to prevent the measuring roll, the load sensor or similar from being damaged in case of an undesired defect, e.g. when the animal pushes the manger downwards with force, there may be provided in both embodiments a safety supporting bracket 101 (Figure 1) respectively 205 (Figure 2) for supporting the feed unit 10; 20.

In the embodiment of Figure 3, the means for weighing the feed present in the feed unit comprise a movable feed unit 30. The feed unit 30 is moved in a reciprocating manner by the motor 38 by which the roll 39 is driven. As a result of this movement there occurs a torque whose magnitude is determined by a device 301 for measuring the magnitude of the torque. The device 301 deduces the weight of the feed present in the feed unit from the torque determined. The exact correlation between torque and amount of feed can previously be determined by means of simple calibration tests.

The embodiment according to Figure 3 has a compact construction due to the fact that the motor 38 for moving the feed unit 30 and the device 301 for measuring the magnitude of the torque during movement and for deducing, from the magnitude of the torque measured, the weight of the feed present in the feed unit 30, are integrated in the housing C.

Although for the roll 39 there may be used a separate torque roll, the roll 39 preferably functions as a drive of the closing means, in this situation constituted by the feed unit 30 itself, as well as a torque roll respectively a measuring roll. Of course the torque can also be measured via said motor.

The fourth embodiment of a feed metering device 4 according to the present embodiment, as shown in Figure 4, comprises means for deterring an animal that wishes to use the feed unit 40, with the aid of data from the animal identification device 42, as well as means for weighing the feed present in the feed unit 40.

The closing means 46, which is rotatable about an axis 45, is set in rotation by a roll 47 which can come into contact with the closing means 46. The roll 47 is driven by a motor 48 which is controlled with the aid of data from the animal identification device 42.

In this embodiment the weighing means are constituted by a feed unit 40 which is rotatable about an axis 49. The feed unit 40 can be brought into contact with the roll 47, and is subjected to a reciprocating motion by correctly controlling the motor 48 that drives the roll 47. By the movement of the feed unit 40 there is generated a torque that can be measured by the torque measuring device 401.

In the situation shown in Figure 4, the roll 47 makes contact with the feed unit 40 and the latter can be set in motion for determining the amount of feed present in the feed unit 40. After an animal has consumed the feed, the amount of remaining feed can be determined by torque measurement. Then the roll 47 is controlled by the motor 48 in such a manner that the feed unit 40 will be partially located in the entrance opening 41. A catching element 402 on the feed unit 40 takes the closing

means 46 along until the latter comes into contact with the roll 47. Then the roll 47 controls the closing means 46 in such a manner that the latter covers the entire entrance opening 41. As a result of the fact that the feed unit 40 is no longer in contact with the roll 47, the feed unit 40 falls back to the starting position in which feed can possibly be added by the feed supplying device 43 via the chute 44.

The fifth embodiment of a feed metering device according to the present invention, as shown in Figure 5, differs from that of Figure 4 by the position of the hinge pin 59 about which the feed unit 50 rotates. The hinge pin 59 is positioned close to the roll 56 for driving the feed unit 50 and measuring the torque, for measuring very small differences in the amount of feed. There is also provided a stop 58 for preventing superfluous movement of the feed unit 50. The closing means 55 for closing the entrance opening 51 pivots about the axis 57.

For the purpose of being able accurately to perform animal identification and to obtain at the same time a compact construction, a feed metering device according to the present invention is characterized in that the animal identification device is disposed in the housing E which is located in the vicinity below the entrance opening. Although the invention has been described on the basis of an animal identification device, possibly provided with weighing and/or deterring means, which is fitted to the so-called stationary world, it is also possible to dispose the animal identification device and/or the weighing and/or deterring means on the (possibly) movable feed unit.